



The U.S. Environmental Protection Agency's **ENERGY STAR® Program** promotes the use of high-efficiency technologies and equipment. ENERGY STAR labeled homes use at least 30% less energy than homes built to meet the national Model Energy Code while maintaining or improving indoor air quality. These fact sheets are designed to help consumers learn more about the energy-efficient improvements to their ENERGY STAR labeled homes.

RIGHT-SIZED AIR CONDITIONERS

MECHANICAL EQUIPMENT IMPROVEMENTS

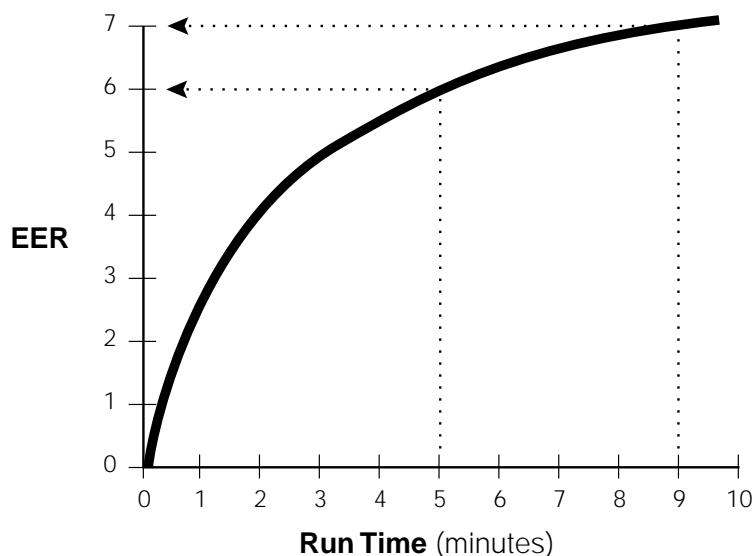
The ENERGY STAR Program promotes right-sized air conditioners where builders carefully match system capacity to home cooling needs. ENERGY STAR labeled homes often include features such as increased insulation, air sealing, high-performance windows, and improved duct systems that can dramatically reduce cooling loads. As a result, smaller, less costly air conditioners can usually be installed.

It is common for builders to install oversized air conditioners because these units provide cooling more quickly, thus avoiding any chance of not meeting the cooling demand. However, oversized air conditioners "short-cycle" or run for shorter periods of time than engineered for optimum operation. The efficiency of air conditioners is low when they first start and increases gradually, reaching peak

efficiency in about 10 minutes. As shown in Figure 1 below, when operating time increases from 5 to 9 minutes, efficiency improves 17 percent. In this example, the energy efficiency ratio (EER) increases from 6 to 7. In addition, bursts of cold air from oversized units can trick the thermostats into shutting off the system before the whole house is cool. Moreover, short operation times do not allow the system to effectively remove humidity with serious repercussions on both home comfort and durability.

Air conditioning accounts for 15 percent of home energy use on average and over 40 percent in hot and humid regions. A right-sized air conditioner is an important part of an energy-efficient home and will result in improved comfort, durability, and lower utility bills.

FIGURE 1: EFFICIENCY VERSUS RUN TIME



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RESOURCES

The following fact sheets are available by calling the U.S. Environmental Protection Agency's toll-free ENERGY STAR Hotline at 1-888-STAR-YES (1-888-782-7937): **Increased Insulation, Air Sealing, High-Performance Windows**, and **Right-Sized/Compact Ducts**.

Bigger Is Not Better consumer brochure available from the Environmental Protection Agency's ENERGY STAR Hotline at 1-888-STAR-YES (1-888-782-7937)

Efficient Air Conditioning fact sheet available from the Energy Efficiency and Renewable Energy Clearinghouse (EREC), P.O. Box 3048, Merrifield, VA 22116, 1-800-DOE-EREC (1-800-363-3732)

BENEFITS

Installing right-sized air conditioners can provide many benefits including:

Improved comfort. Right-sized air conditioners supply conditioned air at a lower volume and over a longer period of time than oversized units. This allows the conditioned air to gradually mix into the space and reduces cold drafts near the supply registers. In addition, right-sized air conditioners provide better dehumidification (see below). These features maintain a more consistent level of comfort throughout a house.

Better humidity control. In order for air conditioners to dehumidify or dry the air, they have to cycle long enough for moisture to condense on the coils and drain away. With oversized units, short-cycling reduces the amount of condensation that drains off the coils and even allows some moisture to evaporate back into the air. Air that is not properly dehumidified can be uncomfortable and promotes the growth of mold and mildew indoors.

Quieter home. Right-sized air conditioners deliver smaller volumes of air over longer periods of time. This reduces indoor noise caused when conditioned air moves through ducts and registers at high speeds and when systems frequently start and stop. In addition, right-sized air conditioners require smaller compressor and fan motors which reduce indoor and outdoor noise when these components are operating.

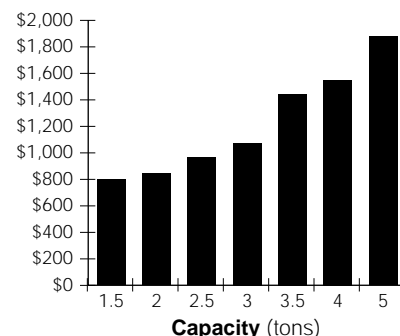
Lower utility bills. Energy consumption increases with the size of air conditioners and decreases with system efficiency. Short-cycling prevents air conditioners from operating at peak efficiency.

Thus, right-sized units provide an equivalent amount of space cooling for less energy consumed. This results in lower utility bills.

Fewer maintenance problems. Short-cycling increases wear and tear. Other maintenance problems, such as dirty filters, leaky ducts, and improper refrigerant charges, are masked by the large output of oversized units. These problems can increase the amount and magnitude of maintenance required by air conditioners and possibly shorten their lives. Since right-sized air conditioners short-cycle less frequently, these maintenance costs are reduced and other maintenance problems are more apparent and more likely to be corrected.

Lower installation price. The purchase price of air conditioning units increases with size. As shown in Figure 2, the price of a 4-ton unit is around \$1,600 while the price of a 3-ton unit is around \$1,100. Right-sizing a 4-ton air conditioning unit with a 3-ton unit can save approximately \$500. It should be noted that some of the savings will go to the builder to compensate for the additional effort required to calculate the cooling loads and select the proper equipment.

FIGURE 2: COST VERSUS CAPACITY



Note: The costs shown above are approximate. Actual cost will vary depending on availability and dealer mark-ups.